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EXAMINER

DAO, THUY CHAN

ART UNIT	PAPER NUMBER
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2192

MAIL DATE	DELIVERY MODE
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11/06/2007

PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary

Application No.

10/630,913

Applicant(s)

SRINIVASAMURTHY ET AL.

Examiner

Thuy Dao

Art Unit

2192

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 03 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 29 August 2007.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-4,6,8,10-14,16,17 and 20 is/are pending in the application.
- 4a) Of the above claim(s) 5,7,9,15 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-4,6,8,10-14 and 16 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☒ Claim(s) 17,20 are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 07/31/03 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO/SB/08)
Paper No(s)/Mail Date _____
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____
- 5) ☐ Notice of Informal Patent Application
- 6) ☐ Other: _____

DETAILED ACTION

1. This action is responsive to the amendment filed on August 29, 2007.
2. Claims 1-4, 6, 8, 10-14, 16-17, and 20 are presented for examination. Claims 17 and 20 are withdrawn from consideration as being directed to a non-elected invention – see paragraphs 6-11 below.

Response to Amendments

3. Per Applicants' request, claims 1, 8, 10-11, and 17 have been amended and claims 5, 7, 9, and 15 have been canceled.
4. The objection to drawings is withdrawn in view of Applicants' amendments.
5. The objection to the abstract and claims 8 and 11 is withdrawn in view of Applicants' amendments.

Restrictions/Election

6. Independent claims 1, 11, 17, and 20 have been significantly amended, which now explicitly direct to distinct inventions, thus prompt this Restriction requirement. Restriction to one of the following inventions is required under 35 U.S.C. 121:

- (I). Claims 1-4, 6, 8, 10-14, and 16: particularly independent claims 1 and 11, are drawn to a method of optimizing an interpreter-based runtime system including a virtual machine (e.g., claim 1, lines 1-3), as classifies in class 717, subclass 152.
- (II). Independent claims 17 and 20 are drawn to a method and a computer program for optimizing the performance of an application running on an interpreter-based runtime system comprising "augmenting bytecode set of the interpreter with new semantically enriched application-specific opcodes ..." (e.g., claim 17, lines 3-4, emphasis added), "wherein the encoding of new semantically enriched opcodes ..." (lines 6-7, emphasis added), as classifies in class 717, subclass 118.

7. The claimed invention of Group I now amended to include at least specific limitations:

“... optimizing the virtual machine based on semantics of the application ...”
(e.g., claim 1, lines 7-8, emphasis added);

“...performing a quantitative trade-off between time and space and encoding semantically enriched code based upon the trade-off ...” (lines 9-10, emphasis added); and

“...statically embedding the semantically enriched code to optimize execution ...”
(lines 13-14, emphasis added),

which is regarded as a distinct and independent invention and not required by Group II.

8. The claimed invention of Group II now amended to include at least specific limitations:

“...augmenting a bytecode set of the interpreter with new semantically enriched application-specific opcodes ...” (e.g., claim 17, lines 3-4); and

“...wherein the encoding of new semantically enriched opcodes efficiently decodes frequently executed codes” (lines 6-7, emphasis added),

which is also regarded as another distinct and independent invention and not required by Group I.

9. Restriction for examination purposes as indicated is proper because all these inventions listed in this action are independent or distinct for the reasons given above and there would be a serious search and examination burden if restriction were not required because one or more of the following reasons apply:

- (a) the inventions have acquired a separate status in the art in view of their different classification;
- (b) the inventions have acquired a separate status in the art due to their recognized divergent subject matter;
- (c) the inventions require a different field of search (for example, searching different classes/subclasses or electronic resources, or employing different search queries);

(d) the prior art applicable to one invention would not likely be applicable to another invention;

(e) the inventions are likely to raise different non-prior art issues under 35 U.S.C. 101 and/or 35 U.S.C. 112, first paragraph.

If claims are added after the election, applicant must indicate which of these claims are readable upon the elected invention.

10. Should applicant traverse on the ground that the inventions or species are not patentably distinct, applicant should submit evidence or identify such evidence now of record showing the inventions or species to be obvious variants or clearly admit on the record that this is the case. In either instance, if the examiner finds one of the inventions unpatentable over the prior art, the evidence or admission may be used in a rejection under 35 U.S.C.103(a) of the other invention (emphasis added).

Applicant is reminded that upon the cancellation of claims to a non-elected invention, the inventorship must be amended in compliance with 37 CFR 1.48(b) if one or more of the currently named inventors is no longer an inventor of at least one claim remaining in the application. Any amendment of inventorship must be accompanied by a request under 37 CFR 1.48(b) and by the fee required under 37 CFR 1.17(i).

11. Since the Applicants have received an action on the merits for the originally presented invention, this invention has been constructively elected by original presentation for prosecution on the merits. Accordingly, **Group II** including **claims 17 and 20** are withdrawn from consideration as being directed to a non-elected invention. See 37 CFR 1.142(b) and MPEP § 821.03.

Response to Arguments

12. Applicants' arguments have been considered but are moot in view of the new ground(s) of rejection. Applicants' amendment necessitated the new ground(s) of rejection presented in this Office action.

Claim Rejections – 35 USC § 102

13. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

14. Claims 1-4, 6, 8, 10-14, and 16 are rejected under 35 U.S.C. 102(b) as being anticipated by US Patent No. 6,865,734 to Holzle et al. (art made of record, hereinafter "Holzle").

Claim 1:

Holzle discloses *a method of optimizing the performance of an interpreter-based runtime system, the runtime system including a virtual machine, the virtual machine adapted to run an application in the context of the runtime environment, the method comprising:*

augmenting the bytecode set of the virtual machine with application-specific codes, thereby constituting an application domain-specific virtual machine (e.g., FIG. 1, compiled byte codes 152, compiled frequently executed code 162, col.4: 22 – col.5: 20);

optimizing the virtual machine based on semantics of the application to be run on the virtual machine (e.g., FIG. 3, col.7: 24 – col.9: 65);

performing a quantitative trade-off between time and space and encoding semantically enriched code based upon the trade-off (e.g., col.1: 55 – col.2: 22; col.4: 43 – col.5: 20);

analyzing frequently executed codes and encoding semantically enriched codes of the instruction set of the virtual machine to efficiently decode the frequently executed codes (e.g., FIG. 6, col.11: 28 – col.12: 38); and

statically embedding the semantically enriched code to optimize execution of the runtime system on the application domain-specific virtual machine (e.g., FIG. 4, col.10: 1-46; FIG. 6, col.11: 28 – col.12: 38; FIG. 1, col.4: 43 – col.5: 20).

Claim 2:

The rejection of claim 1 is incorporated. Holzle also discloses *the virtual machine is a Java Virtual Machine (e.g., col.12: 1-25).*

Claim 3:

The rejection of claim 1 is incorporated. Holzle also discloses *a new application domain-specific virtual machine is generated for different categories of applications (e.g., col.4: 43 – col.5: 20).*

Claim 4:

The rejection of claim 1 is incorporated. Holzle also discloses *the dynamic and/or static behavior of the application is used to create new opcode for the application domain-specific virtual machine (e.g., FIG.1, blocks 158, 162, col.4: 43 – col.5: 20).*

Claim 6:

The rejection of claim 1 is incorporated. Holzle also discloses *the virtual machine is optimized based on a late-binding or dynamic loading model and runtime constant manifestation (e.g., FIG. 6, runtime environment 635, col.11: 51-67).*

Claim 8:

The rejection of claim 1 is incorporated. Holzle also discloses *semantically enriched code is dynamically embedded to enable it to run fast on the application domain-specific virtual machine, said virtual machine newly generated in accordance with claim 1 (e.g., col.2: 25-44).*

Claim 10:

The rejection of claim 1 is incorporated. Holzle also discloses *the semantically enriched code is determined based on the dynamic and/or static behavior of the application* (e.g., FIG. 2, col.5: 21 – col.6: 34).

Claim 11:

Holzle discloses *a method of generating an embedded virtual machine for a specific domain of an application, comprising the step of embedding semantically enriched code in an interpreter loop of the virtual machine to efficiently decode frequently executed code* (e.g., FIG. 1, col.4: 22 – col.5: 20; FIG. 6, col.11: 28 – col.12: 38).

Claim 12:

The rejection of claim 11 is incorporated. Holzle also discloses *the semantically enriched code embedding step is performed dynamically on newly loaded portions of the application in dynamic languages* (e.g., col.2: 21 – col.6: 34).

Claim 13:

The rejection of claim 12 is incorporated. Holzle also discloses *the interpreter is dynamically enhanced* (e.g., col.11: 51-67).

Claim 14:

The rejection of claim 11 is incorporated. Holzle also discloses *secondary codes are used to accommodate the interpretation of new semantically enriched codes* (e.g., col.4: 43 – col.5: 20).

Claim 16:

The rejection of claim 14 is incorporated. Holzle also discloses *if a particular code is used frequently, it is made into a single byte code and the rest of the semantically enriched codes are accommodated by secondary codes* (e.g., col.1: 55 – col.2: 22; col.10: 1-46).

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15. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

16. Claim 11 is rejected under 35 U.S.C. 102(e) as being anticipated by US Patent No. 6,631,515 to Bertis (art made of record, hereinafter "Bertis").

Claim 11:

Bertis discloses *a method of generating an embedded virtual machine for a specific domain of an application, comprising the step of embedding semantically enriched code in an interpreter loop of the virtual machine to efficiently decode frequently executed code* (e.g., FIG. 9, col.7: 16-34; FIG. 4, col.5: 33-67; col.2: 19-41; col.5: 22-31; col.8: 14-30).

Claim Rejections – 35 USC § 103

17. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

18. Claims 1 is rejected under 35 U.S.C. 103(a) as being unpatentable over Bertis in view of US Patent No. 6,014,519 to Egashira (art made of record, hereinafter "Egashira").

Claim 1:

Bertis discloses *a method of optimizing the performance of an interpreter-based runtime system, the runtime system including a virtual machine, the virtual machine adapted to run an application in the context of the runtime environment, the method comprising:*

augmenting the bytecode set of the virtual machine with application-specific codes, thereby constituting an application domain-specific virtual machine (e.g., FIG. 9, col.7: 16-34; FIG. 10, col.7: 35 – col.8: 29);

optimizing the virtual machine based on semantics of the application to be run on the virtual machine (e.g., FIG. 4, col.5: 33-67);

performing a quantitative optimization between time and space and encoding semantically enriched code based upon the optimization (e.g., col.2: 19-41; col.5: 22-31; col.8: 14-30);

analyzing frequently executed codes and encoding semantically enriched codes of the instruction set of the virtual machine to efficiently decode the frequently executed codes (e.g., FIG. 8, col.7: 5-15; FIG. 7, col.6: 46 – col.7: 4); and

statically embedding the semantically enriched code to optimize execution of the runtime system on the application domain-specific virtual machine (e.g., FIG. 9, col.7: 16-34; FIG. 10, col.7: 35 – col.8: 29).

Bertis discloses performing optimization for time and space but does not explicitly disclose *performing a quantitative trade-off between time and space and encoding semantically enriched code based upon the trade-off.*

However, in an analogous art, Egashira further discloses *performing a quantitative trade-off between time and space and encoding semantically enriched code based upon the trade-off (e.g., FIG. 3, col.7:60 – col.8: 53; FIG. 7, col.12: 57 – col.13: 18; col.6: 60 – col.7: 33).*

It would have been obvious to a person having ordinary skill in the art at the time the invention was made to combine Egashira's teaching into Bertis' teaching. One would have been motivated to do so to generate an object module file with a shorter

execution time in a range of code size as suggested by Egashira (e.g., col.2: 45-54; col.3: 22-29; col.3: 62 – col.4: 39).

Conclusion

18. Applicants' amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the date of this final action.

19. Any inquiry concerning this communication should be directed to examiner Thuy Dao (Twee), whose telephone is (571) 272 8570. The examiner can normally be reached on every Tuesday, Thursday, and Friday from 6:00AM to 6:00PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Tuan Q. Dam, can be reached at (571) 272 3695.

The fax phone number for the organization where this application or proceeding is assigned is (571) 273 8300.

Any inquiry of a general nature of relating to the status of this application or proceeding should be directed to the TC 2100 Group receptionist whose telephone number is (571) 272 2100.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR.

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Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

T. Dao

A handwritten signature in black ink, appearing to read 'Tuan Dam', with a stylized, flowing script.

**TUAN DAM
SUPERVISORY PATENT EXAMINER**